

**Energy and Entropy of Crystals, Melts and Glasses
or
what is wrong in Kauzmann's paradox?**

by
Hans-Juergen Hoffmann

Address:

Institute of Materials Science and Technology: Vitreous Materials
University of Technology of Berlin,
Hardenbergstraße 40, 10623 Berlin, Germany

Phone: +49 (0)30/314-22352

Email: hoffmann.glas@tu-berlin.de

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Abstract

In order to understand the thermodynamic properties of solids and melts one has to consider simultaneously their entropy and energy as a function of temperature. Therefore, the molar entropy, S , and enthalpy (energy), H , of crystals, glasses and melts of the same one-component systems have been suitably depicted including the transformation from the melt into a solid, i. e. a glass or crystal. S and H of glasses correspond to a simple continuation of these functions from the molten state to lower temperatures. Since crystallisation occurs spontaneously such a process necessarily produces entropy causing the temperature to increase. Thus, the glassy and the crystalline state are not connected by an isothermal process, which is in contrast to the assumption in the classical nucleation and crystallisation theory as well as in the arguments causing Kauzmann's paradox. For the temperature $T \rightarrow 0K$ the enthalpy and entropy of the glass are larger by ΔH_0 and ΔS_0 as compared to the stable crystal. The calculations are illustrated using experimental data for quartz and silica glass from P. Richet, Y. Bottinga, L. Deniérou, J. P. Petitet and C. Téqui.